

MODIS Dust Mask Algorithm

External Users Manual



Version 1.0
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1. PRODUCTS

1.1. Product Overview

1.1.1. Product Requirements

SPSRB user request # 1009-0016 from NWS/NCEP

NWS/NCEP is preparing for an operational implementation of HYSPLIT dust forecast modeling system (This system is operational now). There is a need for in situ or satellite data to verify the forecasts in near real time. NWS is requesting NESDIS to develop a satellite-based dust aerosol concentration product.

Environmental parameter: Dust mask, dust aerosol optical depth, dust aerosol concentration

1.1.2. Product Description

The MODIS dust mask algorithm is responsible for dust detection for all MODIS pixels for the granules over the United States during daytime. Due to the relatively weak aerosol signal and large uncertainties associated with bright surface, the performance of the current algorithm is expected to be better for heavy dust events. The algorithm output is written in GRIB and NetCDF format for dust flags with values: 0 (no dust) and 1 (dust). The algorithm also produces two bytes of quality control output which includes: Day/Night flag; Land/Ocean flag; Sunglint flag; and Cloud flags.

1.2. Product History

Algorithm has been tested and implemented on STAR computers on a routine basis since 2010. Originally developed for MODIS by University of Wisconsin but substantially enhanced/modified by STAR scientists to adapt it for GOES-R ABI using MODIS as proxy data set.

1.3. Product Access

MODIS Dust Mask Algorithm will be running on NESDIS/OSDPD/OSPO operational servers and be monitored 8x7. Its output will be put on ESPC DDS (Data Distribution Server) serve. Any user who needs to obtain the near real time (NRT) MODIS Dust Mask data need contact ESPC DDS administrator Donna McNamara (Donna.Mcnamara@noaa.gov). She will provide an 'ESPC Data Access Request Form' and detail information about how to access MODIS Dust Mask data on ESPC DDS.

For archive data, please contact ESPC Aerosol Product Area Leader (PAL) Liqun Ma (liqun.ma@noaa.gov)

MODIS Dust Mask algorithm generates two sets of hourly output files: hourly GRIB File and hourly netCDF file(compressed). Only netCDF file will be archived. File naming convention for these two sets of output files are:

MYDdust.aod_conc.v6.3.4.yyyymmdd.hrrh.grib(590KB)

MODIS_DUST.yyyymmdd.hh.nc.gz(90KB,max)

Where,
yyyy is the year
mm is the month
dd is the day
hh is the hour

Examples are:

MYDdust.aod_conc.v6.3.4.20120428.hr17.grib
MODIS_DUST.20120507.22.nc.gz

The content of these two files are:

```
netcdf MODIS_DUST.20120505.17 {  
dimensions:  
    x = 601 ;  
    y = 251 ;  
variables:  
    float combaod(y, x) ;  
        combaod:long_name = "DUST AOD" ;  
        combaod:unit = "none" ;  
        combaod:NoAODRetrievals = "-1" ;  
        combaod:NoDust = "-2" ;  
        combaod:NoGranuleCoverage = "-99999" ;  
    float combconc(y, x) ;  
        combconc:long_name = "DUST Column Concentration Density" ;  
        combconc:unit = "Kg/m^3" ;  
        combconc:Cloud = "-1" ;  
        combconc:Sunglint = "-2" ;  
        combconc:NoGranuleCoverage = "-3" ;  
        combconc:NoData = "-9999" ;  
  
// global attributes:  
    :Title = "MODIS DUST " ;  
    :Platform = "MODIS/Aqua" ;  
    :DataType = "LatLonGrid" ;  
    :NorthWestConnerLat = "50.0f" ;  
    :NorthWestConnerLon = "125.0f" ;  
    :LatGridSpacing = "0.1f" ;  
    :LonGridSpacing = "0.1f" ;  
    :Year = "2012" ;  
    :Month = "05" ;  
    :Day = "05" ;  
    :Hour = "17" ;  
}
```

2. ALGORITHM

2.1. Algorithm Overview

Uses spectral contrast and variability tests for different channels ranging from visible to IR to determine the presence of dust in MODIS/VIIRS granules.

Use the dust mask pixels to tag the independently derived MODIS aerosol optical depth (AOD) product in those pixels as “dust AOD”.

Converts dust AOD to dust concentration using mass extinction efficiency and the assumption that the dust aerosols are present in the lowest 5 km.

Detail info is described in ATBD.

2.2. Input Satellite Data

MODIS Dust Mask requires MODIS level1 and level2 data that include MOD021KM, MOD03, MOD04_L2, MOD07_L2 and MOD35_L2.

2.2.1. Satellite Instrument Overview

All input data for this product are from MODIS Aqua. Detail information for MODIS Aqua can be find at :<http://modis.gsfc.nasa.gov/>

2.2.2. Input Satellite Data Description

MODIS/Aqua Calibrated radiances-1km(MOD21KM) - HDF4

2.3. Input Ancillary Data

MODIS/Aqua Aerosol Product(MOD04) - HDF4

MODIS/Aqua Cloud Mask(MOD35) – HDF4

MODIS/Aqua Geolocation Data Set(MOD03) - HDF4

MODIS/Aqua snow/ice mask – HDF4

MODIS/Aqua sunglint mask – HDF4

MODIS/Aqua day/night flag – HDF4

3. PERFORMANCE

3.1. Product Testing

3.1.1. Test Data Description

Test data is from NASA MODIS website: ladsweb.nascom.nasa.

The specific data sets are:

MOD021KM.P2012071.1725.hdf
MOD021KM.P2012071.1730.hdf
MOD021KM.P2012071.1905.hdf
MOD021KM.P2012071.1910.hdf
MOD021KM.P2012071.2040.hdf
MOD021KM.P2012071.2045.hdf
MOD021KM.P2012071.2050.hdf
MOD03.P2012071.1725.hdf
MOD03.P2012071.1730.hdf
MOD03.P2012071.1905.hdf
MOD03.P2012071.1910.hdf
MOD03.P2012071.2040.hdf
MOD03.P2012071.2045.hdf
MOD03.P2012071.2050.hdf
MOD04_L2.P2012071.1725.hdf
MOD04_L2.P2012071.1730.hdf
MOD04_L2.P2012071.1905.hdf
MOD04_L2.P2012071.1910.hdf
MOD04_L2.P2012071.2040.hdf
MOD04_L2.P2012071.2045.hdf
MOD04_L2.P2012071.2050.hdf
MOD35_L2.P2012071.1725.hdf
MOD35_L2.P2012071.1730.hdf
MOD35_L2.P2012071.1905.hdf
MOD35_L2.P2012071.1910.hdf
MOD35_L2.P2012071.2040.hdf
MOD35_L2.P2012071.2045.hdf
MOD35_L2.P2012071.2050.hdf
MYDdustaod.v6.3.4.P20120311.hr17.png
MYDdustaod.v6.3.4.P20120311.hr19.png
MYDdustaod.v6.3.4.P20120311.hr20.png
MYDdustconc.v6.3.4.P20120311.hr17.png
MYDdustconc.v6.3.4.P20120311.hr19.png

3.1.2. Unit Test Plans

Detailed information is located in 'Implementation and Test Plans for MODIS Dust Mask Product'

3.2. Product Accuracy

3.2.1. Test Results

Test results are reviewed by developer and installation programmer. Test data also put on ESPC anonymous ftp site 'satepsanone' for user to test.

3.2.2. Product Accuracy

Accuracy of products, as measured by V&V testing, and compared to accuracy requirements. Refer to relevant test reports. (Document Object 39)

Accuracy of this product is determined by comparing to CALIPS vertical feature mask(VFM) product that identifies dust in different layers of the atmosphere.

Accuracy: 67.59

Probability of Detection(DOd): 54.23%

3.3. Product Quality Output

Described in section 1.3(product Access)

3.4. External Product Tool

'wgrib' can be used to quick look at MODIS Dust Mask GRIB file.

'ncdump' and HDFView can be used to quick look at MODIS Dust Mask NetCDF file.

4. PRODUCT STATUS

MODIS Dust Mask product is a brand new product installed and maintained by ESPC since July 2012.

4.1. Operations Documentation

ATBD

External Users Manual

System Maintenance Manual

Operational procedure(for ESPC help desk use only)

Operational log (for ESPC maintenance use only)

4.2. Maintenance History

Maintenance history is recorded in Operational log.

END OF DOCUMENT